

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

Paper No. 22

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SCOTT J. BRABEC, KENNETH R. BRENNEN,
WILLIAM J. SCHNINDELDECKER STANTEN C. SPEAR, ROGER E. RUGLAND
and BRUCE C. JOHNSON

Appeal No. 2002-0897
Application 09/303,020

ON BRIEF

Before OWENS, WALTZ, and LIEBERMAN, *Administrative Patent Judges*.
OWENS, *Administrative Patent Judge*.

DECISION ON APPEAL

This appeal is from the final rejection of claims 1-20,
which are all of the claims remaining in the application.

THE INVENTION

The appellants claim a method for forming a structure having
a cavity within a semiconductor wafer. Claim 1 is illustrative:

1. A method of forming a structure in and on a
semiconductor wafer, comprising the steps of:

forming a layer on a top surface of the semiconductor wafer and within a cavity formed in the wafer such that at least a portion of the cavity remains open;

polishing a portion of the layer formed above a plane defined approximately by a top surface of the semiconductor wafer;

megasonically cleaning the semiconductor wafer including the open portion of the cavity; and

brush scrubbing the semiconductor wafer to clean the open portion of the cavity.

THE REFERENCES

Doan et al. (Doan)	5,391,511	Feb. 21, 1995
Kirlin et al. (Kirlin)	5,976,928	Nov. 2, 1999
		(filed Nov. 20, 1997)
Roy et al. (Roy)	5,996,594	Dec. 7, 1999
	(effective filing date Nov. 30, 1994)	

THE REJECTION

Claims 1-20 stand rejected under 35 U.S.C. § 103 as being unpatentable over Doan taken with Roy and Kirlin.¹

OPINION

We affirm the aforementioned rejection.

The appellants state that the claims stand or fall together (brief, page 3). We therefore limit our discussion to one claim,

¹Rejections of claims 1-10 under 35 U.S.C. § 112, first paragraph, and claims 1-20 under 35 U.S.C. § 103 over U.S. 5,779,520 to Hayakawa taken with Doan and Kirlin are withdrawn in the examiner's answer (page 2).

i.e., claim 1. See *In re Ochiai*, 71 F.3d 1565, 1566 n.2, 37 USPQ2d 1127, 1129 n.2 (Fed. Cir. 1995); 37 CFR § 1.192(c) (7) (1997).

Doan discloses a method of forming a structure in and on a semiconductor wafer, comprising forming a layer (22) on a top surface (26) of the semiconductor wafer and within a cavity (24) formed in the wafer such that at least a portion of the cavity remains open (col. 3, lines 19-22; figure 5), chemical mechanical polishing (CMP) a portion of the layer formed above a plane defined approximately by a top surface of the semiconductor wafer (col. 3, lines 23-35; figure 6), and megasonically cleaning the semiconductor wafer including the open portion of the cavity (col. 3, lines 36-59). Doan does not disclose brush scrubbing the wafer. Doan, however, teaches that "[o]ther techniques are also expected to be usable to remove chemical mechanical polishing slurry residuals from the outwardly open polysilicon cavity" (col. 4, lines 12-15).

Roy discloses a post-CMP process which includes megasonically cleaning a wafer and then brush scrubbing the wafer to further remove particles and ionic and metallic contaminants (col. 3, lines 10-16; col. 4, lines 23-25; col. 5, lines 22-39). Roy does not disclose applying the process to a surface having a

cavity therein. Roy describes the process only in conjunction with a CMP cleanup process for interlevel dielectric films, but states that "[i]t will be apparent to those skilled in the art that the invention is also applicable to CMP of other films, such as metal films including tungsten, aluminum, and copper damascene" (col. 2, lines 53-57).

The appellants argue that "**Roy et al.** teaches 'a CMP cleanup process for interlevel dielectric films' (col. 2, lines 52-55) and specifically relate[s] to overcoming the problem of 'agglomeration (gelling) of silica particles after polishing' caused by drying of the silica particles and resulting bonding of the particles to the surface of the wafer (see col. 1, lines 40-52; col. 2, lines 52-54). Thus, **Roy et al.** does not relate to cleaning an open portion of a cavity, as claimed" (brief, page 14). The appellants also argue that "there is no cognizable motivation within **Roy et al.** or **Doan et al.** to substitute or complement the cleaning methods of **Doan et al.** with the cleaning methods in **Roy et al.**, as **Roy et al.** relates specifically to a problem of silica bonding on interlevel dielectric films caused by the drying of wafers following CMP" (brief, pages 14-15).

Contrary to the appellants' argument, Roy does not limit his process to interlevel dielectric films but, rather, indicates that the process is applicable to CMP of other films (col. 2, lines 54-57). Hence, the appellants' argument that Roy "relate[s] particularly to planarization of interlevel dielectric films" (reply brief, page 2) is not well taken.

As for the appellants' argument that Roy's process is specifically directed toward preventing the CMP silica particles from drying and thereby gelling and bonding to the surface of the wafer, Roy teaches that the wafer surface is preferably kept wet throughout the cleanup process to prevent such gelling and bonding, but does not indicate that the disclosure is limited to a process for preventing that gelling and bonding (col. 4, lines 32-40).

The appellants argue that "there is no reasonable expectation of success provided in the prior art (i.e., absent the benefit of Appellant's disclosure) that the addition of brush scrubbing of **Roy et al.** to the process of **Doan et al.** would clean an open portion of a cavity. Moreover, the teachings of both **Roy et al.** and **Doan et al.** fail to support the Examiner's

conclusion that the brush scrubbing of **Roy et al.** would necessarily clean an open portion of a cavity provided by **Doan et al.**" (reply brief, pages 2-3).

The reasonable expectation of success in using Roy's brush scrubbing to clean particles out of Doan's open cavity would have been provided to one of ordinary skill in the art by Roy's teaching that his post-CMP cleanup process is applicable to CMP of films other than interfacial dielectric films (col. 2, lines 53-56). This teaching would have indicated to one of ordinary skill in the art that Roy's brush scrubbing is applicable to CMP of films generally, including both smooth and cavity-containing films.

Regarding the appellants' argument that the references do not indicate that Roy's brush scrubbing necessarily would clean particles out of Doan's open cavity, we note that both the appellants (specification, page 8, lines 12-13) and Roy (col. 5, lines 29-30; col. 6, lines 15-18) appear to use conventional wafer layer cleaning brushes. Due to this apparent similarity of the brushes, it reasonable appears that the brushes provide the same or substantially the same effect. See *In re Spada*, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657-58 (Fed. Cir. 1990).

The appellants argue (reply brief, page 3):

Roy et al. teach "[t]he HF spray *after scrubbing* removes metal contaminants to below detection limits" (**Roy et al.**, col. 6, lines 30-32) (emphasis added). If anything, **Roy et al.** suggest[s] on its face that the brush scrubbing and megasonic cleaning (col. 5, lines 22-36) fail to accomplish the task of cleaning the surface of the wafer and require a HF spray to remove the residuals (col. 6, lines 30-32). Appellants respectfully submit that one skilled in the art would conclude from **Roy et al.** that since brush scrubbing is not able to remove all residuals from a flat surface (col. 6, lines 30-32), it would not effectively clean an open cavity in a semiconductor wafer.

Actually, what Roy discloses is that "[t]he HF spray after scrubbing removes most of the metal contaminants to below detection limits" (col. 6, lines 30-32). Thus, Roy indicates that some residuals remain even after the HF spray. Roy teaches that each of the steps contributes to the removal of unwanted particles from the wafer surface (col. 6, lines 35-37). One of ordinary skill in the art, therefore, would not have been discouraged by Roy from using brush scrubbing to remove particles from a cavity-containing surface.²

²Hence, we are not persuaded by the appellants' argument that one of ordinary skill in the art would have been led by Doan and Roy to use only variants of the HF process and not brushing to remove particles from an open portion of a cavity in a semiconductor wafer (reply brief, page 3).

The appellants argue that each of Doan's claims requires an HF dip (reply brief, page 3). This argument is not well taken because Doan's disclosure is not limited to the claims. Instead, all of Doan's disclosures must be evaluated for what they would have fairly suggested to one of ordinary skill in the art. See *In re Boe*, 355 F.2d 961, 965, 148 USPQ 507, 510 (CCPA 1966).

The appellants argue that one of ordinary skill in the art would not have used Roy's brush scrubbing in Doan's method because the benefits of brush scrubbing do not clearly outweigh the disadvantages of adding a new and different process step (reply brief, page 4). This argument is unpersuasive because it is not supported by evidence. Arguments of counsel cannot take the place of evidence. See *In re De Blauwe*, 736 F.2d 699, 705, 222 USPQ 191, 196 (Fed. Cir. 1984); *In re Payne*, 606 F.2d 303, 315, 203 USPQ 245, 256 (CCPA 1979); *In re Greenfield*, 571 F.2d 1185, 1189, 197 USPQ 227, 230 (CCPA 1978); *In re Pearson*, 494 F.2d 1399, 1405, 181 USPQ 641, 646 (CCPA 1974). Moreover, the appellants have not established that benefits of a process step must clearly outweigh its disadvantages for a *prima facie* case of obviousness of a method including that step to be established.

The appellants argue that Roy uses a low concentration HF spray containing 0.25-1.0 wt% HF, whereas Doan's required HF dip uses a higher HF concentration of 5-100 parts by volume of a 49% HF solution per volume of water, and that Roy's brush scrubbing does not lend itself to Doan's method which requires much more intense HF processing (reply brief, pages 4-5).

Actually, both Roy (col. 5, lines 36-38) and Doan (col. 3, lines 60-62) indicate that the HF treatment is optional. Regardless, Roy's teaching that brush scrubbing is effective for removing particles and ionic and metallic contaminants (col. 5, lines 38-39) would have fairly suggested, to one of ordinary skill in the art, use of brush scrubbing with Doan's megasonic cleaning and optional HF treatment to further clean the layer surface.

The appellants argue that a comparison of split conditions "B" and "D" in Roy's figure 13 indicates that Roy's HF spray, when used in combination with brush scrubbing, appears relatively ineffective for reducing total defect counts (reply brief, page 5). Roy teaches that figure 13 indicates that the HF spray after scrubbing removes most of the metal contaminants to below detection limits (col. 6, lines 30-32), and figure 13 shows that the average total defect count when brush scrubbing is used alone

is comparable to that obtained when brush scrubbing and HF are used in combination (i.e., about 58 counts versus about 50 counts). Consequently, this figure would have indicated to one of ordinary skill in the art that brush scrubbing, whether used alone or in combination with HF, is effective for reducing the total defect count to at or near the below-detection level.

For the above reasons we are not convinced of reversible error in the examiner's conclusion that it would have been *prima facie* obvious to one of ordinary skill in the art to use Roy's brush scrubbing in Doan's post-CMP cleanup method. For this reason and because the appellants have not provided evidence of secondary considerations for overcoming the *prima facie* case of obviousness, we affirm the examiner's rejection.³

³ A discussion of Kirlin, which is relied upon by the examiner for a disclosure of the barrier layer required by the appellants' dependent claim 17 (answer, page 3), is not necessary to our decision.

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DECISION

The rejection of claims 1-20 under 35 U.S.C. § 103 over Doan taken with Roy and Kirlin is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFIRMED

TERRY J. OWENS)	
Administrative Patent Judge)	
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)	BOARD OF PATENT
THOMAS A. WALTZ)	
Administrative Patent Judge)	APPEALS AND
)	
)	INTERFERENCES
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